UNIGRAPHICS

MULTI-AXIS MACHINING

WORKBOOK

November 2002

MT11050 – Unigraphics NX

EDS Inc.

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Multi-Axis Machining Workbook Publication History:

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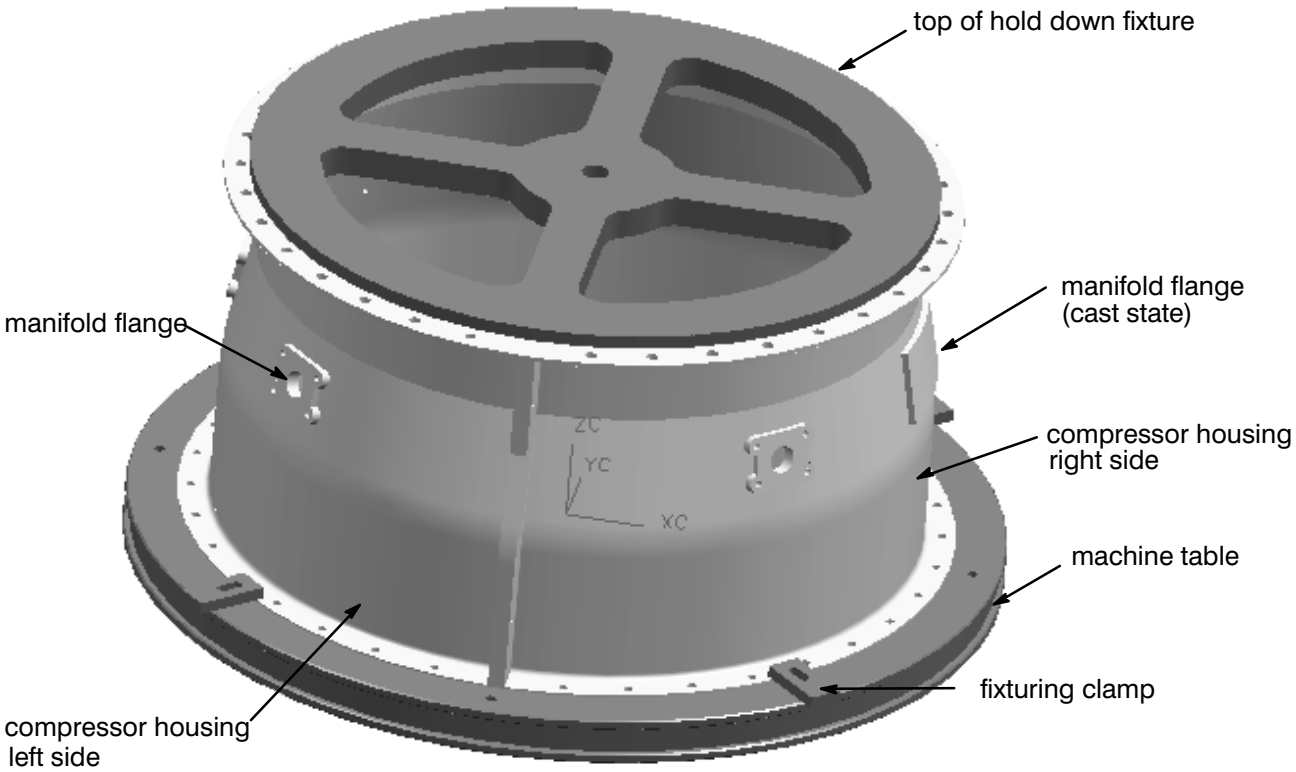
The Manufacturing Process

The workbook project consists of various aspects of multi-axis machining of a part of a manufacturing assembly, in this case a turbine compressor housing. The manufacturing assembly is comprised of a fixture with associated clamping devices and the left and right hand castings of the compressor housing. The compressor housing is considered to be the *Master Model* and the fixture, with associated clamping devices, are considered component parts of the assembly.

For this project the compressor housing will be machined on a 5-axis machining center. You will center drill, drill and ream the 34 holes on the top flange of the housing and then machine the various intake manifold flanges located on the side of the housing. All tools used in the various operations have been previously defined for you.

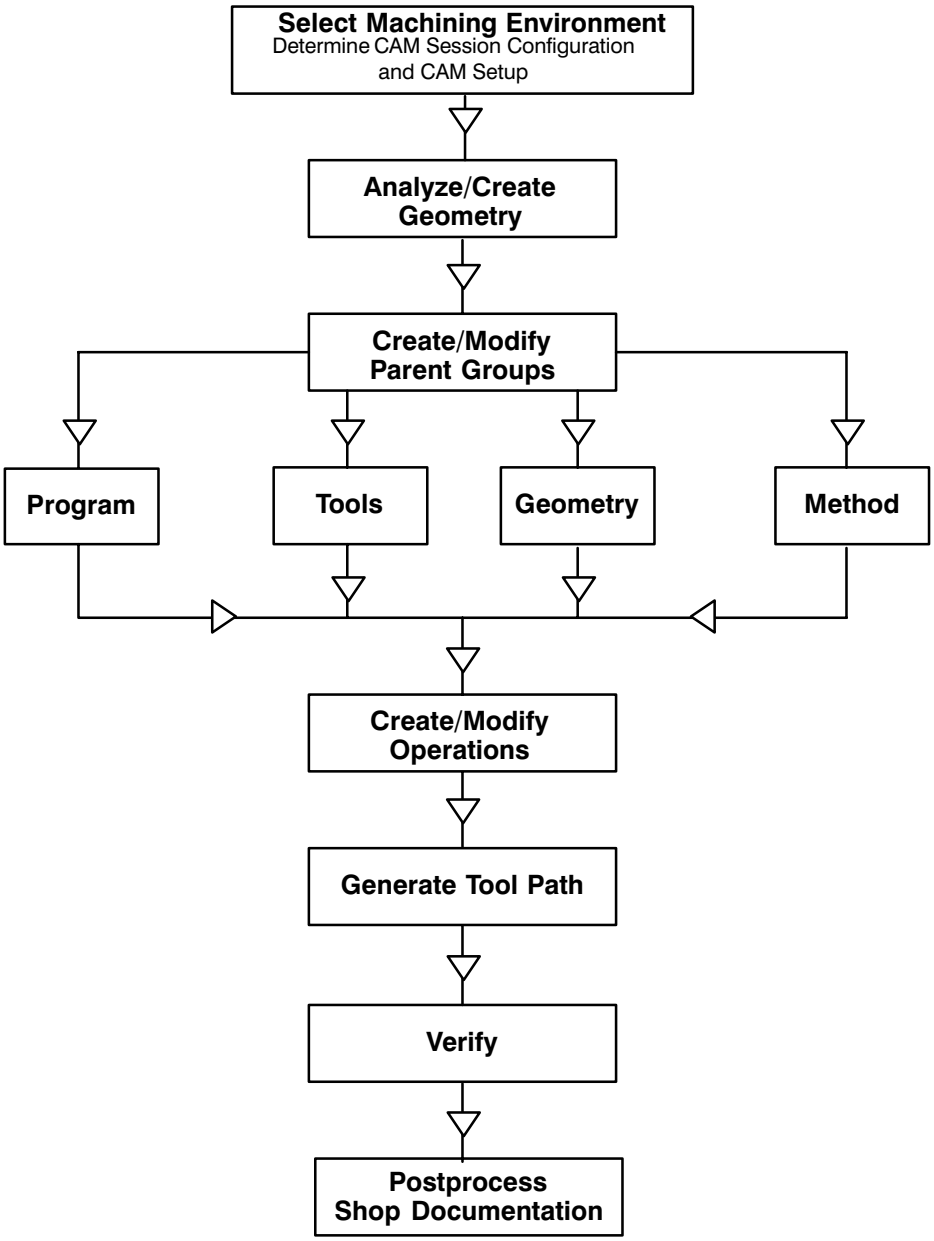
The following illustration represents the manufacturing assembly that you will use in the NC/CNC programming process.



The manufacturing processes or methods that you will use, in this workbook, may or may not be the same approach, in order or content, that you would use at your company. The end result, the final part, is the same. What is more important, in this class, is gaining an understanding of the methodology and application of using the various Multi-axis machining options of the Manufacturing Application of Unigraphics, allowing you to customize tool path generation to methods or processes that you are familiar with.

The following flowchart illustrates the Manufacturing process steps that you will use when creating and processing tool paths in Unigraphics.

Unigraphics Manufacturing Process



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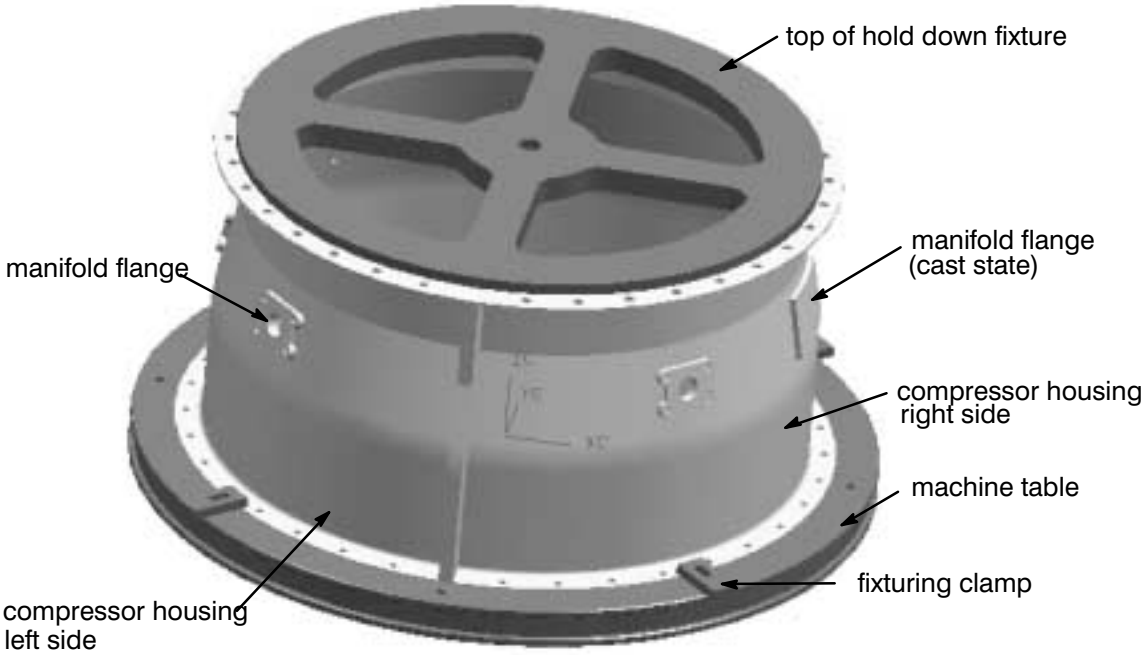
Drilling the top flange

Section 1

Prior to creating the operations that are necessary to machine the top flange, take the time to become familiar with this project part.

Step 1 Open the part, mam_compressor_assy_mfg.prt from the workbook parts directory.



Step 2 Rename the part ***_compressor_assy.prt where * represents your initials.**

Step 3 Examine the assembly and the various component parts using the Assembly Navigator.

Step 4 Enter the Manufacturing Application.

Notice that there were no previous operations or parent group, other than the defaults.

Step 5 Change to the Tool View of the Operation Navigator.

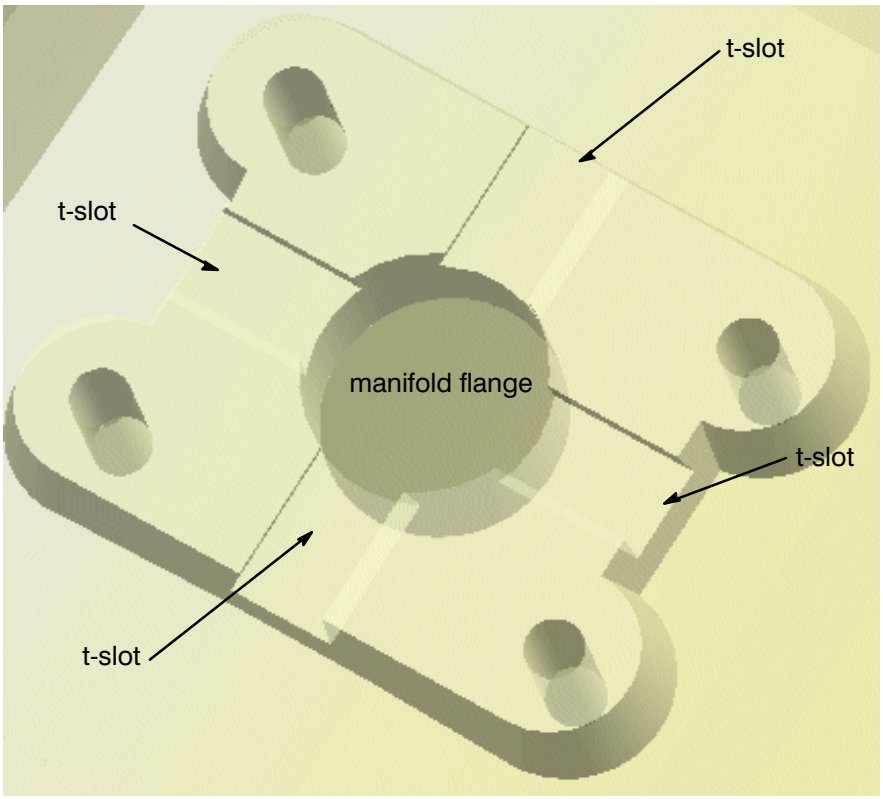
Note that all the tools required for the various machining operations are already defined for you.

Step 6 Create the Machining Environment.

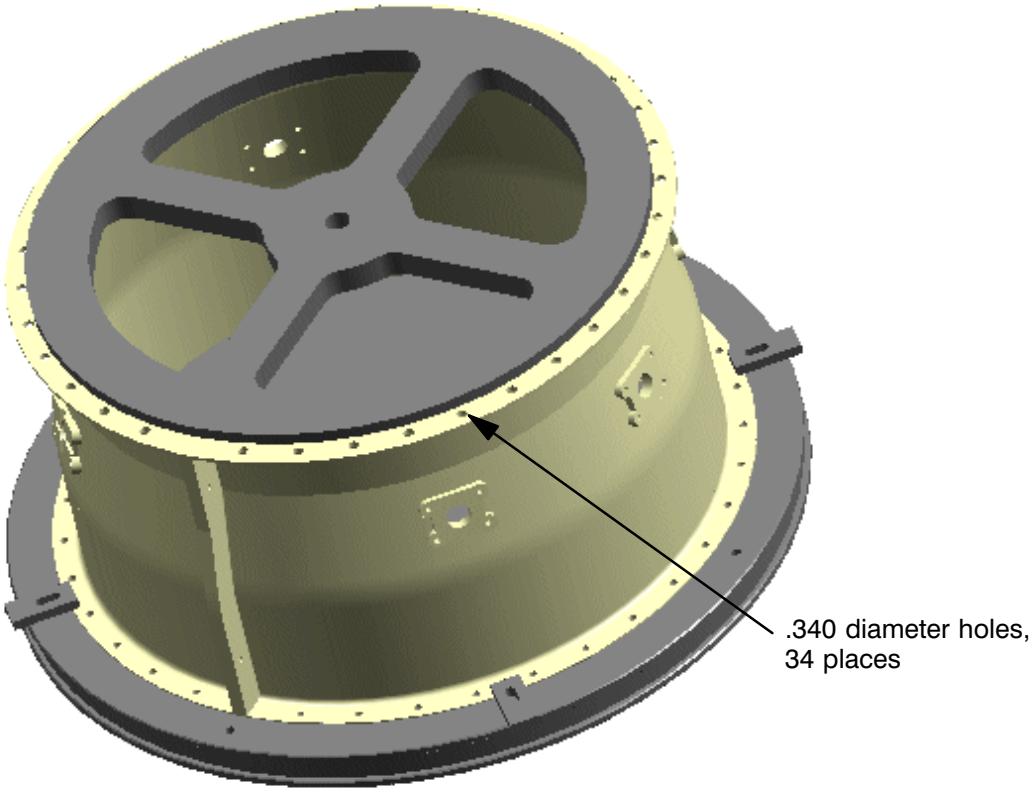
The Machining Environment has already been determined for you, in this case it is multi-axis.

Step 7 Determine the geometry and Machine Co-ordinate systems.

Analyze the geometry needed for the various machining operations. For this project you will be drilling the holes on the top flange as well as machining the manifold flanges that are cast on the part. The manifold flanges require milling and drilling operations. Note that only one of the manifold flanges has a horizontal and vertical “t-slot”.



You will begin this project by spot-drilling, drilling and reaming 34 holes located on the top flange, as shown. Remember to specify the MCS at the center of rotation of the table since this part will be machined on a 5-axis tilt and rotating table machining center.



Step 8 Create the operations necessary to spot-drill, drill and ream the 34 holes located on the top flange.

Use the following tools:

SPOTDRILLING_TOOL
Z_DRILL_.413
RM_.420

Step 9 Use the Visualization function to verify your tool paths.

Step 10 Save the part file.

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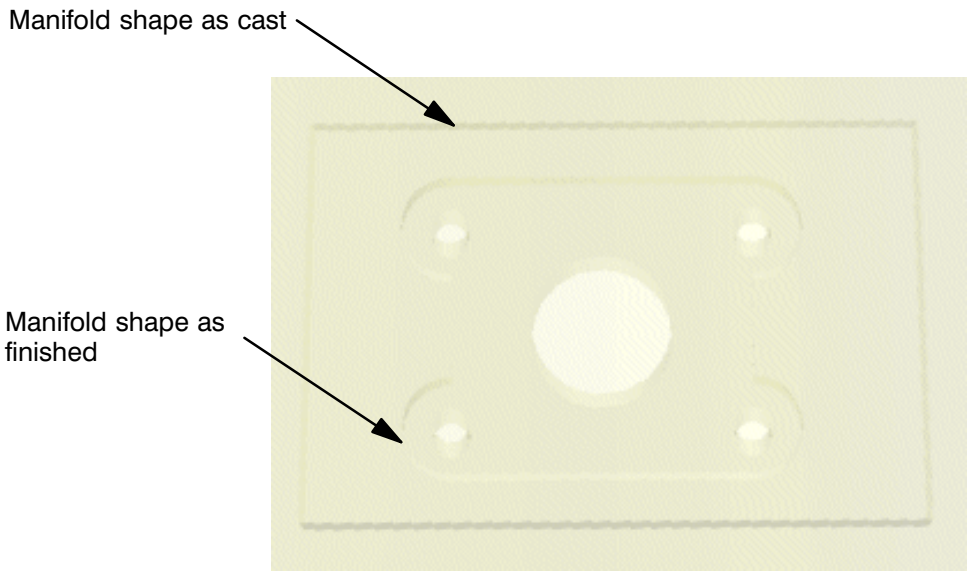
Sequential Mill – Cutting the Manifold flange

Section 2

In this section, you will machine the manifold flange as shown below, using Sequential Mill operation types.

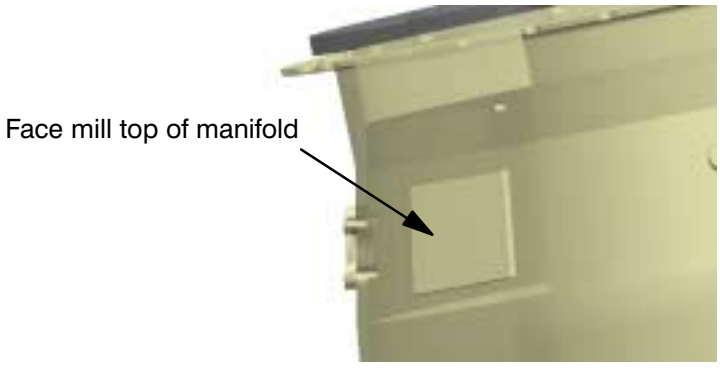


Step 1 Continue using ***_compressor_assy_mfg.prt.

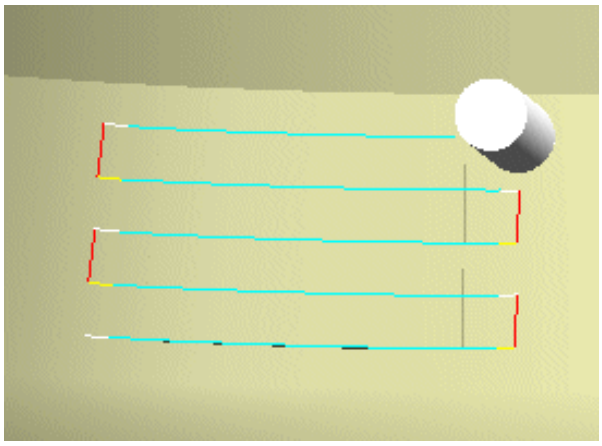
Step 2 Create a new program named SEQ_MILL_PROG.

When creating operations, use meaningful names. All operations created for Sequential Milling will use SEQ_MILL_PROG as the parent object.

Step 3 Face the top of the pad, using Sequential Milling techniques.

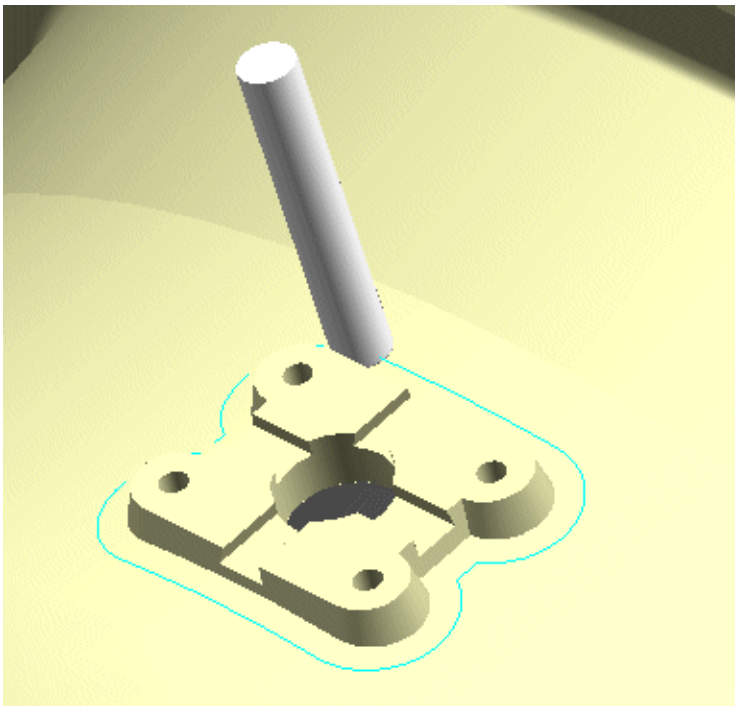


Use tool EM1.00X0 and verify your results. Your tool path should be similar to the following illustration.



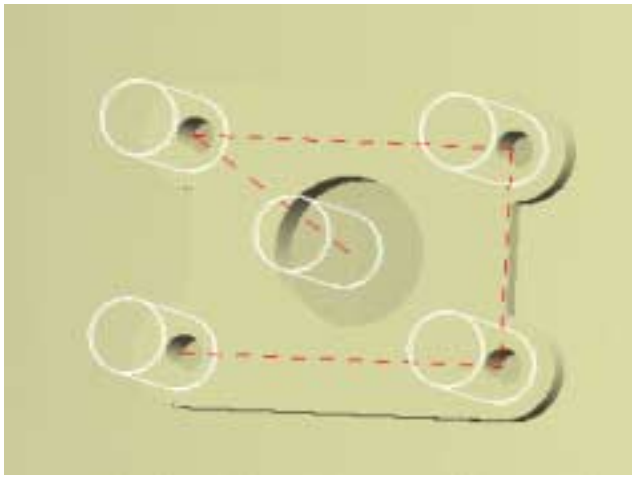
Step 4 Create a Sequential Milling operation to machine the outer periphery of the manifold flange.

Use tool EM_.500x.03 and verify your results. Your tool path should like similar to the following illustration.

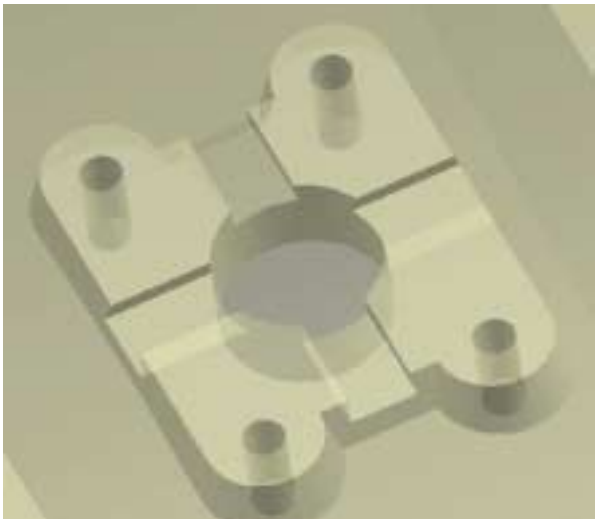


Step 5 Spot drill, and drill the Manifold flange.

Use the following tools:
SPOTDRILLING_TOOL
DRILL_.250
DRILL_1.00
Verify your results. Your tool path should like similar to the following illustration.



Step 6 Create a Sequential Milling tool path to machine the dovetail slots.



Use tool EM_.250x.03 and verify your results. Use the looping technique of Sequential Mill to rough the dovetail slot.

Step 7 Save and close the part file.

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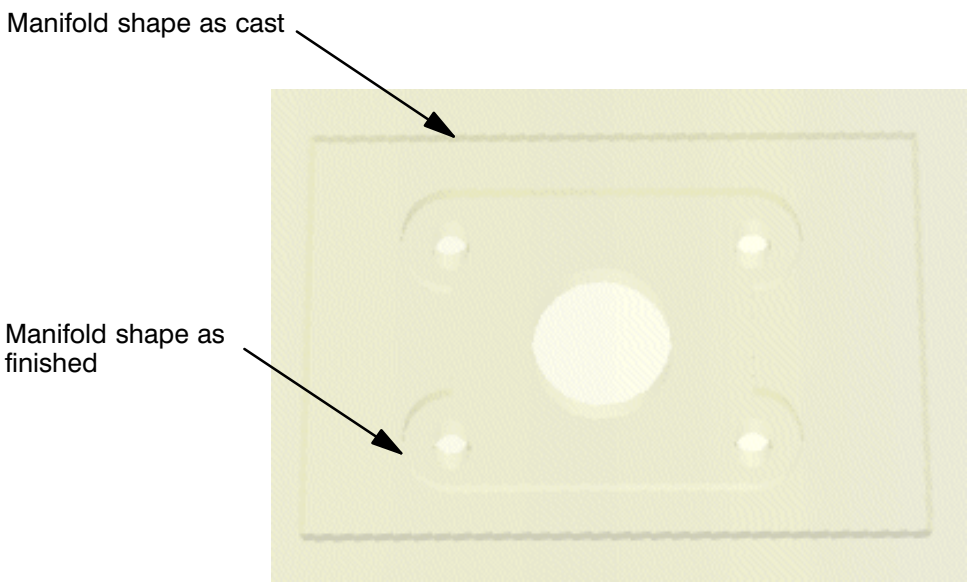
Variable Contour — Cutting the Manifold flange

Section 3

In this section, you will machine the manifold flange as shown below, using Variable contour operation types. The cutting sequence will be identical to the sequence that you used in Sequential Mill. The purpose of doing this project with Sequential Mill and Variable Contour operations will allow you to compare differences between the two processors. In most multi-axis situations, you will probably use a combination of each method to machine your parts.

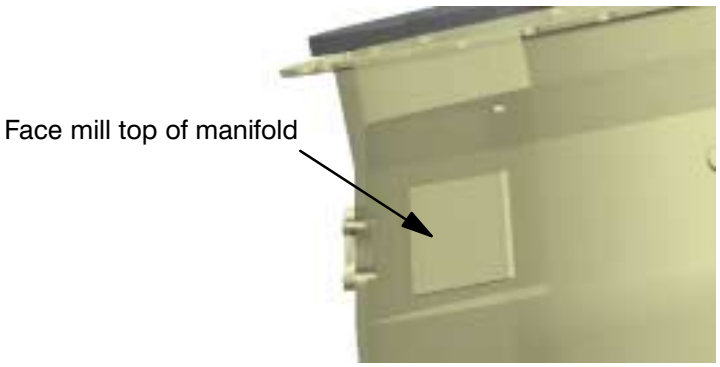


Step 1 Continue using ***_compressor_assy_mfg.prt.

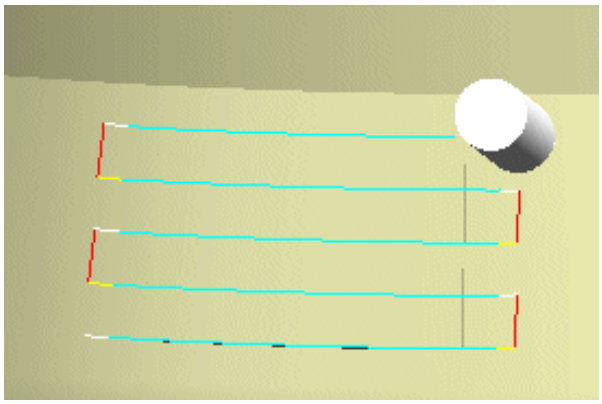
Step 2 Create a new program named VAR_CONTOUR_PROG.

When creating operations, use meaningful names. All operations created for Variable Contour will use VAR_CONTOUR_PROG as the parent object.

Step 3 Face the top of the pad, using Variable Contouring techniques.

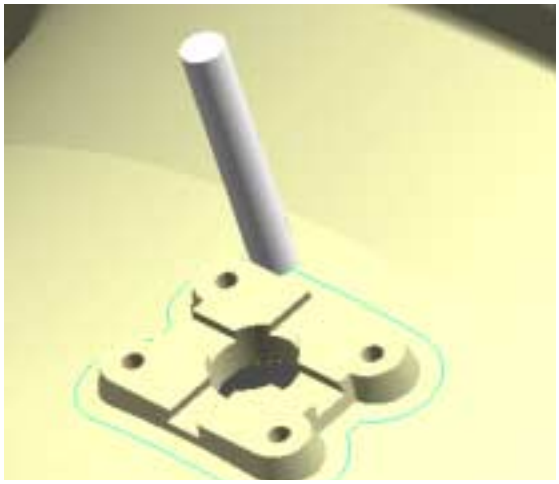


Use tool EM1.00X0 and verify your results. Your tool path should be similar to the following illustration.



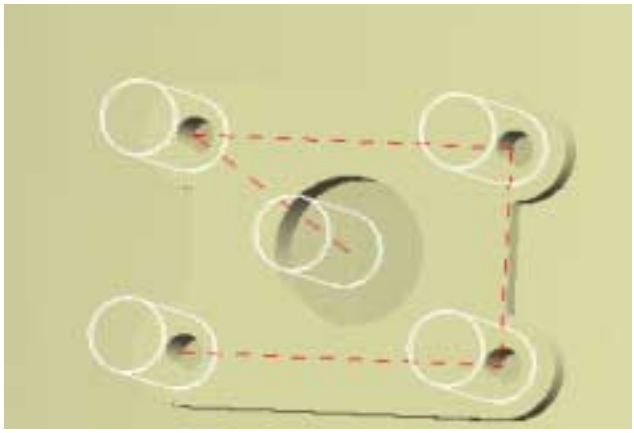
Step 4 Create a Variable Contour operation to machine the outer periphery of the manifold flange.

Use tool EM_.500x.03 and verify your results. Your tool path should like similar to the following illustration.

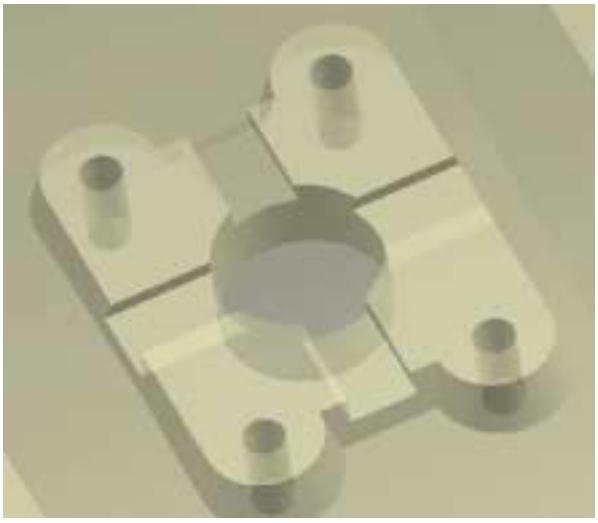


Step 5 Spot drill, and drill the Manifold flange.

Use the following tools:
SPOTDRILLING_TOOL
DRILL_.250
DRILL_1.00
Verify your results. Your tool path should like similar to the following illustration.



Step 6 Create a Variable Contour tool path to machine the dovetail slots.



Use tool EM_.250x.03 and verify your results.

Step 7 Save and close the part file.

This completes the project.

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